Conformity Determination of the 2019-2022 Transportation Improvement Program and the Amended *Maximize2040*

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(APPENDICES ARE AVAILABLE ONLINE AT WWW.BALTOMETRO.ORG)

INTRODUCTION

The transportation conformity process is required under the Clean Air Act to ensure that transportation planning and air quality planning processes within a state are coordinated. Emissions from mobile sources are amongst the most significant contributors to ozone pollution. Because of this, the transportation conformity process is a critical element of the region's and the State's efforts to address environmental issues.

This report documents the demonstration of transportation conformity of the 2019-2022 Transportation Improvement Program (TIP) and the amended *Maximize 2040*, the long range transportation plan for the Baltimore region (the Plan), to address conformity to the 8-hour ozone National Ambient Air Quality Standard (NAAQS). Under the Clean Air Act Amendments of 1990, areas designated as nonattainment for a NAAQS are required to review their current transportation plans and programs to ensure conformity with the applicable state air quality implementation plan. Since the passage of the CAAA, EPA released a final rule on November 24, 1993 outlining methods for nonattainment areas to conduct conformity analyses of plans and programs. EPA has amended the final rule (the Conformity Rule) on a number of occasions, with the most recent occurring in April 2012.

The conformity analysis documented here was conducted through a quantitative and qualitative review of the projects in the Plan and TIP. The conformity determination process ensures that long-range transportation plans and short-term programs contribute to air quality improvement objectives delineated in the State Implementation Plan. In determining conformity, MPO officials estimate the future emissions produced by the planned transportation system. These emission projections are then compared with the emission levels established in the State Implementation Plan.

This conformity determination is undertaken by the Baltimore Regional Transportation Board (BRTB), in its capacity as the Metropolitan Planning Organization for the Baltimore metropolitan area. The BRTB, assisted by the Baltimore Metropolitan Council and in conjunction with the Maryland Departments of the Environment and Transportation, conducted a comprehensive analysis of conformity of the Plan and the TIP for the Baltimore region. The approach used for this conformity determination was developed in concert with the Conformity Rule.

CURRENT ATTAINMENT STATUS FOR NAAQS

Eight-hour Ozone Standard

The Baltimore region has recently been designated as "marginal" nonattainment for the 2015 8-hour ozone standard. The standard is 0.070 parts per million (ppm). Once this designation becomes effective, the region will have one year to perform a conformity determination for this NAAQS. Earlier, in 2012, the region was designated as "moderate" nonattainment for the 2008 8-hour ozone NAAQS. At the time, under this rule the Baltimore region was designated the only "moderate" ozone nonattainment area for the 2008 8-hour ozone standard in the East. The Baltimore region is a "serious" nonattainment area for the 1997 ozone standard.[1]

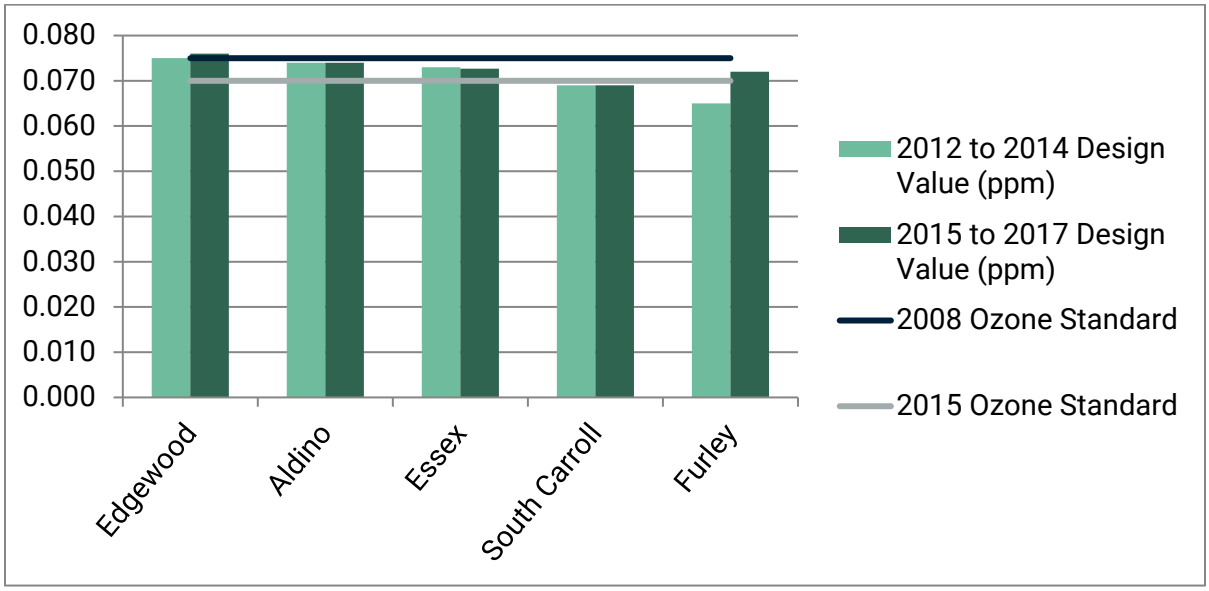
The most current approved/adequate ozone budgets are used in the transportation conformity process. This conformity determination demonstrates conformity to the 1997 ozone NAAQS and the 2008 ozone NAAQS using the 2012 8-hour ozone Reasonable Further Progress (RFP) SIP budget. The 8-hour ozone RFP SIP was prepared by the Maryland Department of the Environment (MDE) and contains motor vehicle emissions budgets for volatile organic compounds (VOC) and nitrogen oxides (NO_X). The RFP budgets were determined by U.S. EPA as adequate for use in conformity determinations, as published in the Federal Register on February 22, 2016.

Mobile source emissions are among the most significant local contributors to the Baltimore area's ozone problem. The Baltimore region's attainment date for the 2008 Ozone NAAQS is July 20, 2018.

Figure 1 shows the monitored values of ozone at each monitor in the Baltimore region. These "design values" are shown for the year ranges of 2012-2014 and 2015-2017. These values are shown alongside the ozone NAAQS set in 2008 and 2015. Data for the Davidsonville, Padonia and Glen Burnie monitors is not shown, as monitoring data at those locations are not available for all years. The highest design value for the Baltimore region is 75 ppb as of the end of the 2017 ozone season, indicating that it is currently meeting the 2008 NAAQS, but not the 2015 NAAQS.

[1] In 2015, the US EPA issued a final rule revoking the 1997 ozone NAAQS. (80 FR 12264) However, a February 2018 court ruling reinstated the 1997 ozone NAAQS conformity requirement.

Figure 1. Baltimore Region Ozone Monitors: Ambient Air Quality 8-Hour Ozone Design Values, (2012 to 2014) and (2015 to 2017)



Prior Conformity Determinations for Maximize 2040 – the Baltimore Region's Long Range Transportation Plan

As mentioned above, *Maximize2040* is the financially constrained long range transportation plan for the Baltimore region. *Maximize2040* was approved by the BRTB, the region's federally-designated MPO, on November 24, 2015, along with its conformity determination for the 1997 annual PM2.5 and 2008 ozone NAAQS, and the CO NAAQS. At that time the conformity determination also addressed the amended 2016-2019 TIP. Since that time there have been several conformity determinations. Now, a new short range transportation improvement program (TIP) has been developed for FY 2019-2022. This conformity determination shows conformity of the new TIP and the amended plan to the SIP discussed above.

Table 1 below provides an overview of conformity determinations of *Maximize2040*, ordered from the current one down to the earliest one.

Table 1. List of Conformity Determinations

Conformity Document	Approval Date(s)	Pollutants Addressed	Horizon Years Tested	Emissions Model
Conformity Determination of the 2019-2022 TIP and the Amended Maximize2040	BRTB: TBD	1997 Ozone, 2008 Ozone NAAQS	2020, 2030, 2040	MOVES 2014a
Amendments to Maximize2040 and the Amended FY 2018-2021 TIP with Air Quality Conformity Determination: I-95 Express Toll Lane Northbound Extension, I-695: I-70 to MD 43	BRTB: March 27 2018	2008 Ozone NAAQS	2030, 2040	MOVES 2014a
Conformity Determination of the 2018-2021 TIP and the Amended Maximize2040	BRTB: July 25, 2017	2008 Ozone NAAQS	2020, 2030, 2040	MOVES 2014a
Amendment to Maximize2040 and the Amended FY 2016-2019 Transportation Improvement Program with Air Quality Conformity Determination: Section 00 of I-95, Moravia Road to Fort McHenry Tunnel	BRTB: August 23, 2016	2008 Ozone NAAQS, Annual PM2.5 NAAQS	2017, 2025, 2035, 2040	MOVES 2014
Conformity Determination of the 2017-2020 TIP and the Amended Maximize2040	BRTB: July 26, 2016	2008 Ozone NAAQS, Annual PM2.5 NAAQS	2017, 2025, 2035, 2040	MOVES 2014
Amendment to Maximize2040 and the Amended FY 2016-2019 Transportation Improvement Program with Air Quality Conformity Determination: MD 32, MD 108 to Linden Church Rd	BRTB: April 26, 2016	2008 Ozone NAAQS, Annual PM2.5 NAAQS, CO NAAQS (CO for display only, not required)	2017, 2025, 2035, 2040	MOVES 2014
Conformity Determination of Maximize2040 and the Amended 2016-2019 TIP	BRTB: November 24, 2015	2008 Ozone NAAQS, CO NAAQS, Annual PM2.5 NAAQS	2017, 2025, 2035, 2040	MOVES 2014

Maximize 2040 – the Baltimore Region's Long Range Transportation Plan

Maximize 2040 is the financially constrained long range transportation plan for the Baltimore region, and was approved by the BRTB, the region's federally-designated MPO, on November 24, 2015. The Plan was amended several times since then to move two projects on MD 32 ahead in time from 2030 to 2020 and 2021. It was amended to add a project on I-95: from Moravia Road to the Fort McHenry Tunnel. It was also amended to add the I-95 Express Toll Lane Northbound Extension and the I-695: I-70 to MD 43 projects. The I-695: MD 122 to I-95 project was removed.

The new short range transportation improvement program (TIP) for FY 2019-2022, is being approved concurrent with the conformity determination. This conformity determination shows conformity of the new 2019-2022 TIP and the amended *Maximize2040* long range transportation plan.

CONFORMITY STATEMENT

The conformity rule, as it applies to the Baltimore nonattainment area, requires the Plan and TIP to conform to the motor vehicle emissions budgets established in the SIP. The applicable SIP for this Conformity Determination of the Amended *Maximize 2040* and the 2019-2022 TIP is the 2012 8-hour ozone Reasonable Further Progress (RFP) SIP budget for the Baltimore region (motor vehicle emission budgets determined adequate by EPA on February 22, 2016). Appendix A contains a matrix, which provides responses to all of EPA's criteria as applicable to this conformity determination.

The results of the conformity analysis for the Baltimore nonattainment area indicate that the projected mobile source emissions are below the most recent approved/ adequate motor vehicle emission budgets for the established analysis years of 2020, 2030, and 2040. Therefore, it is the conclusion of the Baltimore Regional Transportation Board, in its capacity as the Metropolitan Planning Organization for the Baltimore region, that the Amended *Maximize 2040* and the 2019-2022 Transportation Improvement Program are found to be in conformity with the requirements of the Clean Air Act Amendments of 1990 and the relevant sections of the Final Transportation Conformity Regulations 40 CFR Part 93.

INTERAGENCY CONSULTATION

Under Section 93.105 of the Conformity Rule, each State Implementation Plan revision must include procedures for interagency consultation before making conformity determinations, and also procedures to be undertaken by air quality agencies and transportation agencies before developing applicable implementation plans. On January 9, 2007, after public review and comment, Maryland state regulations codifying the interagency consultation process (26.11.26) were updated to reflect transportation conformity regulations for the 8-hour ozone and $PM_{2.5}$ NAAQS, the changes to the Conformity Rule, as well as incorporation of existing federal guidance that is consistent with a U.S. Court of Appeals decision.

For the Baltimore region, the BRTB established the Interagency Consultation Group to carry out the consultation process and provide recommendations on air quality topics. Final procedures for consultation were prepared and formally endorsed by consultation members (TSC Resolution 96-12). Final consultation procedures were developed through a cooperative effort involving the BRTB staff, MDOT and MDE staffs, as well as U.S. EPA and Federal Highway Administration representatives. These procedures provide the framework that the BRTB follows in making conformity determinations.

The ICG meets formally to discuss and recommend appropriate procedures for determining conformity of the Plan and TIP. These meetings are critical to the findings reported in this document, as well as to the development of the consultation procedures that will govern future conformity determinations. ICG meetings provide an additional forum for public participation and input to the process, including comments on technical methodologies. Meetings are advertised on the Internet. Agendas, meeting minutes and necessary materials are emailed to interested parties.

Table 2. ICG Meetings Specifically Addressing this Conformity Analysis

February 1, 2018	Review and approval of methodology/assumptions
April 4, 2018	Review and approval of conformity status of projects
May 16, 2018	ICG approves conformity determination regional emissions analysis results.
July 11, 2018	ICG recommendation for BRTB approval of conformity determination.

Please see Appendix B for more information on the Interagency Consultation Process related to this conformity determination. Decisions relating to the exempt/non-exempt status of projects are available in Appendix C.

CONFORMITY PROCESS

Test Method

One of the first steps in the conformity determination process is to determine which test method to use – whether an interim emissions test or a budget test, and what the applicable budgets are. Through interagency consultation, it was determined that the budget test would be used to address the ozone NAAQS.

According to the "Transportation Conformity Guidance for 2008 Ozone Nonattainment Areas," if 1997 8-hour ozone budgets are available for each analysis year in a conformity determination for the 2008 8-hour ozone NAAQS, an area would use 1997 ozone budgets that are established for that year or the most recent prior year. On February 22, 2016, EPA determined the motor vehicle emissions budgets in the Baltimore 1997 8-hour Ozone

Standard RFP SIP for 2012 to be adequate for use in conformity determinations. The conformity testing for the 2008 ozone NAAQS was performed using these budgets for VOCs and NO_X. The conformity determination for the 1997 ozone NAAQS also uses these budgets for VOCs and NO_X.

Selection of Horizon Years

In order to perform the technical analysis for the Plan and TIP, three horizon years were chosen through interagency consultation in order to analyze emission results. The date of full implementation of the long range transportation plan, 2040, is a required model year. The other two horizon years are 2020 and 2030, test scenarios set so that there are no more than 10 years between horizon years. The years of analysis shown in Table 3 have been determined in keeping with federal requirements.

Table 3. Horizon Years

Year	Analysis Required	Ozone Test
2020	Yes – intermediate year	Budget Test – RFP budget for 2012 for the 1997 ozone standard
2030	Yes – intermediate year	Budget Test – RFP budget for 2012 for the 1997 ozone standard
2040	Yes – last year of transportation plan	Budget Test – RFP budget for 2012 for the 1997 ozone standard

Emission Analysis Software

The EPA-developed MOVES 2014a motor vehicle emissions model, in combination with PPSuite, was used to assist the analysis of emissions of volatile organic compounds and oxides of nitrogen resulting from onroad mobile sources in the Baltimore region. PPSuite is a software package used to pre-format and post-format data to and from MOVES 2014a.

Staff of the BMC Transportation Planning Division applies the travel forecasting model to horizon year scenarios to assess highway and transit system travel and speed impacts of implementing the region's proposed transportation plan (Plan) and program (TIP). Upon completion of travel forecasting, MDE uses the MOVES 2014a computer model to estimate the emission effects of the projected transportation system usage and performance characteristics.

Identification of Exempt and Regionally Significant Projects

All projects from the Amended *Maximize2040* and the 2019-2022 TIP and were reviewed and categorized as either “exempt” or “non-exempt.” Projects that are exempt from the conformity requirement may proceed forward even if there is no conforming plan and TIP. Exempt projects are identified in §93.126 and §93.127 of the Conformity Rule. Exempt projects in the TIP generally include projects with neutral or de minimis emissions impacts such as road

rehabilitation and resurfacing, streetscape improvements, bridge replacements and bicycle and pedestrian facilities.

Non-exempt projects are not exempt from the requirement to determine conformity. Non-exempt, regionally significant projects are included in the regional emissions analysis. According to §93.101 of the Conformity Rule, regionally significant projects are non-exempt transportation projects that are "on a facility which serves regional transportation needs (such as access to and from the area outside of the region, major activity centers in the region, major planned developments such as new retail malls, sports complexes, etc., or transportation terminals as well as most terminals themselves) and would normally be included in the modeling of a metropolitan area's transportation network, including, at a minimum, all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel." According to §93.122 of the Conformity Rule, non-exempt, non-regionally significant projects are not required to be modeled explicitly, but VMT must be estimated according to reasonable professional practice.

TCM Statement

The current SIP does not include any Transportation Control Measures. Therefore, neither the budgets nor the conformity analysis reflect Transportation Control Measures. The region continues to program and implement emission reduction measures in many areas including commuter assistance activities, bicycle/pedestrian activities, park-and-ride lots, public transit, management and operations projects, preferential parking management, and clean vehicles, fuels and technologies. Appendix I provides descriptions of some of the emission reducing activities in the region. It also includes a longer listing of data collected from tracking the status of "emission-friendly" projects in the region.

PUBLIC INVOLVEMENT

The BRTB is currently updating their Public Participation Plan. The new draft updates information detailed in a previous version based on Fixing America's Surface Transportation (FAST) Act, a federal law that authorizes transportation funding to address such things as new technologies and a review of the most effective public involvement practices. The plan was created in coordination with the Public Advisory Committee and other stakeholders. The public involvement procedures provide a framework and methodology for involving the public in all metropolitan planning activities. The draft Public Participation Plan is available online at www.baltometro.org.

There was a 30-day public comment period on the Draft Conformity Determination, beginning May 23, 2018. This public comment period meets the transportation conformity public participation requirements in 93.105 (e) of the Conformity Rule, which states that reasonable public access be provided to technical and policy information at the beginning of the public comment period and prior to taking formal action on a conformity determination for all

transportation plans and TIPs. There were opportunities for the public to comment in person on the Draft Conformity Determination during several meetings listed below.

- May 16, 2018 Interagency Consultation Group – results presented with support to release for public review
- June 6, 2018 Public Advisory Committee – review and comment opportunity on the Conformity Determination and the 2019-2022 TIP
- June 26, 2018 BRTB Meeting – public participation opportunity
- July 11, 2018 Joint Interagency Consultation Group/ Technical Committee Meeting – the ICG and TC recommends BRTB approval of the Conformity Determination
- July 24, 2018 BRTB Meeting – approval of the Conformity Determination and the 2019-2022 TIP

The Conformity Determination and its appendices were made available at www.baltometro.org throughout the public comment period. The document was available online and in printed format at the Regional Information Center, located at the Baltimore Metropolitan Council.

FISCAL CONSTRAINT

Federal transportation legislation requires regional long-range plans to include a list of the transportation investments planned to commence during the next 20 to 25 years. This federal legislation also mandates that the long-range transportation plan be financially constrained. That is, the estimated cost of the capital investments in the Plan must not exceed the revenues reasonably projected to become available.

The May 2016 Metropolitan Planning Regulations require that existing and proposed revenues cover all forecasted capital, operating, and maintenance costs identified in the Plan. To comply with this rule, the BRTB must identify all sources of anticipated revenue available in support of its investment decisions. Further, the 2016 planning regulations require that revenue and cost estimates in the Plan must use an inflation rate to reflect "year of expenditure" dollars. This rate must be based on reasonable financial principles and information, developed cooperatively by the MPO and the state.

For the federal and state inputs to the most recent long range transportation plan update, known as *Maximize2040*, the BRTB relied on revenue projections generated by the Maryland Department of Transportation (MDOT). The Department's Office of Finance as well as Office of Planning and Programming work closely to develop the financial forecast that the BRTB subsequently reviews and endorses.

MDOT, working closely with its financial consultants, has over several years and numerous plans established a consistent and reliable methodology to forecast the funding necessary to support plans generally, and *Maximize2040* specifically. The process uses generally accepted principles, assumptions, and historic spending levels to identify realistically anticipated revenues and expenditures, over a 25- to 30-year horizon.

The forecast developed by MDOT and submitted to the BRTB was adopted in October 2014 to provide an understanding of the funding reasonably expected to be available as the Preferred Alternative was being developed. *Maximize2040*, Appendix E: Revenues and Cost Estimates, includes the assumptions and documentation for the financial plan. This material shows that forecasted revenues are sufficient to cover anticipated investments, given the best information available.

LATEST PLANNING ASSUMPTIONS

Socioeconomic Data

Estimates of travel on horizon year networks are based on the completed Round 9 Cooperative Forecasts. These forecasts were endorsed by the BRTB at their July 24, 2018 meeting. The Cooperative Forecasting Group, responsible for the development of regional socioeconomic projections that are used in travel demand forecasting, meets bimonthly to discuss modifications and to set the groundwork for future estimates of land use activity. These agreed-upon regional forecasts represent a planning scenario created to extend through 2045. The forecasts estimate the number of households, population, labor force, retail employment, non-retail employment, and median household income by transportation analysis zone for 2020, 2025, 2030, 2035, 2040, and 2045. Appendix D displays jurisdictional totals for the major socioeconomic data.

Transit Systems and Operating Assumptions

The Baltimore Metropolitan Council maintains a Trip-Based Model (TBM) for the Baltimore metropolitan area which includes Anne Arundel County, Baltimore City, Baltimore County, Carroll County, Harford County, Howard County and a portion of Queen Anne's County. The TBM is composed of three major inputs: 1) demographic data files, 2) highway network and 3) transit network. The transit network includes all bus and rail transit service for the Baltimore region. This includes the following service providers and a description of their operations:

- **Baltimore Link / Maryland Transit Administration (MTA)**
    - Modes: Metro-SubwayLink, Light RailLink, Commuter Rail (MARC), CityLink (bus), LocalLink (bus), Express BusLink (bus), & Commuter Bus
    - Serves: Anne Arundel County, Baltimore City, Baltimore County, Harford County, Howard County & Queen Anne's County
    - Number of Bus Routes: 73

    - Map: MTA System Map
- **Regional Transportation Agency (RTA)**
    - Modes: Local Bus
    - Serves: Anne Arundel County & Howard County
    - Number of Bus Routes: 16
    - Map: RTA System Map
- **Trailblazer / Carroll Transit**
    - Modes: Local Bus
    - Serves: Carroll County
    - Number of Bus Routes: 4
    - Route Information: Trailblazer Routes
- **Harford Transit**
    - Modes: Local Bus
    - Serves: Harford County
    - Number of Bus Routes: 11
    - Map: LINK System Map
- **Annapolis Transit**
    - Modes: Local Bus
    - Serves: Anne Arundel County
    - Number of Bus Routes: 7
    - Map: Annapolis Transit System Map

Transit Projects

BMC staff reviews each providers' periodic changes to their service and incorporates those changes into the TBM's transit network. BMC models a base year and forecast years for highway and transit networks. The current base year is 2012. The 2019-2022 air quality conformity forecast years are 2020, 2030 and 2040. These networks include transit projects found in the Transportation Improvement Program (TIP) and the current long-range plan (Maximize 2040). The following projects change the transit service for the region in the future:

- **MARC Growth and Investment Plan** – a capacity expansion plan for MARC service on the Penn and Camden lines. MARC service on both Baltimore-area lines will increase with more trains and reduced headways (wait times). A *Maximize 2040* project, scheduled for completion in 2025 through 2029.
- **MTA Green Line** – an extension of the Metro-Subway from Johns Hopkins Hospital to North Avenue with two new stations: Broadway (includes a new MARC station) and East North Avenue. A *Maximize 2040* project, scheduled for completion in 2035.

Transit Modeling Results

BMC used the TBM to test conformity for the years 2020, 2030 and 2040. The following are the transit ridership results (see Table 4).

Table 4. Average Weekday Transit Ridership Projections

	2020	2030	2040
Home-Based Work	112,857	108,164	109,042
Home-Based Shop	44,696	45,876	46,600
Home-Based Other	65,079	66,504	71,365
Home-Based School	24,904	24,684	24,033
Non-Home Based Journey to/from Work	14,575	14,463	14,775
Non-Home Based Journey at Work	505	505	515
Non-Home Based Other	26,053	26,870	27,529
Total	**288,669**	**287,066**	**293,859**

For an overview of transit services in the region, reference Appendix I for more information.

Toll Facilities

The Baltimore region currently has five toll facilities, including three harbor crossings, one managed lane facility, and the Chesapeake Bay crossing. The harbor crossings are traditional toll facilities with a toll plaza, which handles cash and electronic toll transactions. The passenger car toll for the harbor crossings is $4.00 for cash transactions, $3.00 for Maryland EZ Pass users or $1.40 for commuter plan users. For additional tolling information on the harbor crossings, including truck tolls, see:

http://www.mdta.maryland.gov/Toll_Rates/harbor_crossings_rates.html.

The harbor crossings include:

I-95, Fort McHenry Tunnel

I-895, Baltimore Harbor Tunnel

I-695, Frances Scott Key Bridge

The managed lane facility, known as Electronic Toll Lanes (ETL), is on I-95 north of Baltimore. It connects I-95 and I-895 at the eastern city line to MD 43, White Marsh Boulevard and I-95 north, a distance of eight miles. A connection to I-695, Baltimore Beltway is planned for 2025 as part of *Maximize2040*. The ETL's are tolled at a per-mile rate, which amounts to $2.54 peak / $2.19 off-peak for video toll users and $1.54 peak / $1.19 off-peak for electronic toll users. For more information on the ETL toll rates see:

http://www.mdta.maryland.gov/ETL/Toll_Rate_Schedule.html.

The Bay Bridge (US 50/301) toll for passenger cars is $4.00 for cash transactions, $2.50 for Maryland EZ Pass users, $2.00 for shoppers, or $1.40 for commuter plan users.

Within the travel demand model, the effects of tolls are reflected in trip distribution, mode choice and route assignment. The tolls are converted to travel time using $14.00 an hour as the value of time and is added to the ETLs calculated travel time based on the travel speed. The travel cost (time) is fed into trip distribution. During mode choice, the dollar cost of traveling on the ETL is calculated and added to the auto operating cost for the utility of single occupant vehicle (SOV) and shared ride. Route choice travel time for all roads is based on the travel time to traverse the road section, including the toll time where applicable. The assignment algorithm chooses the path that minimizes travel time. During periods of high congestion, the ETLs become the preferred choice over the general purpose lanes due to their time (cost) savings.

Selection of Network Facilities

A series of computerized highway and transit networks was prepared and tested for each modeled horizon year (2020, 2030, and 2040) under the Plan and TIP implementation scenario. The implementation scenario is the future transportation system that will result from the goals and policies proposed in the Plan and TIP in given horizon years. Criteria for inclusion of highway and transit improvements in the implementation scenario were reviewed by the ICG, including representatives from MDOT and MDE. As described above, the ICG members discuss which projects in the Plan and TIP, as well as regionally significant projects, are exempt from the regional emission analysis.

Additionally, BRTB member jurisdictions provided highway and transit project specifications for all regionally significant non-federally funded highway and transit projects that have committed funding sources and could reasonably be expected to be completed by the appropriate analysis year.

The following were included:

- All in-place regionally significant highway and transit facilities, services, and activities;
- Completion of all regionally significant projects (including facilities, services, and activities) included in the proposed Plan and TIP;
- Completion of all expected regionally significant non-FHWA/FTA highway and transit projects that have clear funding sources and commitments leading toward their implementation and completion by the analysis year.

TECHNICAL METHODOLOGY

The regional emissions analysis used to demonstrate conformity utilizes both the BMC staff-supported four-step travel demand forecasting model, in addition to the EPA MOVES 2014a model and the PPSuite model. The travel demand forecasting model incorporates economic and demographic data to assist in simulating the transportation modeling process: trip generation, trip distribution, mode choice, and trip assignment. Significant changes have been made to the regional travel demand models providing more reliable future year travel simulations. With these changes, the model is better positioned to analyze and produce conformity results. The latest model update is documented and is available upon request (BMC, *Baltimore Region Travel Demand Model Version 4.4 – Model Validation for 2010 Base Year*). The introduction of this report is included in Appendix E of this conformity report.

Representative highway and transit networks and trip tables were developed to correspond with conditions expected in the horizon years of 2020, 2030, and 2040 resulting from projects in the 2019-2022 TIP and the Amended *Maximize2040*.

Procedures for Determining Regional Transportation-Related Emissions

The Baltimore region is using EPA's MOVES 2014a model for regional emissions analyses. A commercially-available software package (entitled Central) was used to manage the process of connecting output from the travel model to the MOVES 2014a model that estimates mobile emissions. The Central package takes travel demand model output and generates the needed MOVES transportation files and imports the information into the appropriate MOVES database. Other non-transportation databases (meteorological data, vehicle registration, motor fuel parameters and Inspection and Maintenance (IM)) are imported into the appropriate MOVES database. After importing local planning assumptions, the MOVES emissions model is used to generate gram per mile emission factors which are applied to the local travel activity. The process is completed by generating user-friendly summaries of the MOVES output emission databases.

The following general steps summarize the mobile emission estimation process:

- Output travel demand model estimates of daily-, a.m.- and p.m. peak-period link totals and truck volumes;
- Convert travel demand model estimates of daily link total and truck volume to seasonal HPMS adjusted hourly estimates;
- Estimate link volume by vehicle class (motorcycle, 2 axle, bus, and 2 axle 6 tire and 3+ axles)
- Calculate new travel speed;
- Prepare MOVES transportation related files;
- Prepare MOVES non-transportation assumptions, environmental assumptions, control program specification files, fuel parameter, source type, population, and fleet age distribution;

- Execute MOVES, estimating mobile gram per mile composite emissions for each pollutant and by vehicle type; and
- Develop summaries showing estimated mobile source emissions by vehicle type for each pollutant and converted to tons per day.

The Conformity Rule contains transportation-related emissions determination procedures that must be implemented in nonattainment areas. The Baltimore region has maintained a process for a number of years that meets the modeling requirements under §93.122(b)(1)(i) through (vi) for designated severe ozone nonattainment areas. Since the revocation of the 1-hour ozone standard on June 15, 2005, the Baltimore region is no longer a severe nonattainment area for 1-hour ozone. As mentioned previously, the region is a designated moderate nonattainment area for the 2008 8-hour ozone standard. However, the region still follows the same procedures and meets the requirements of a severe nonattainment designation. BMC staff, on behalf of the BRTB, simulates travel demand associated with implementation of plans and programs. MDE is responsible for all non-transportation emissions model inputs.

Travel information within a database format (dBase) is used in exchanging link characteristics between the travel demand modeling software TP+ and PPSUITE. Estimated link volume is adjusted using jurisdiction Highway Performance Monitoring System (HPMS) factors and seasonal factors (1.04 percent for average summer weekday and 0.938 percent for average winter weekday) by facility type and area type. The HPMS factors are derived from the 2012 travel demand model. The 2012 HPMS adjustment factors used are provided in Appendix F. The 2012 HPMS factors are closer to one on the upper class facilities and are greater as the facility class decreases due to less representation of the highway network within the travel demand model. The travel model includes all interstates but only skeleton representation of the lower class facilities especially in the more developed jurisdictions. Factoring by the HPMS factors compensates for differences between simulated volume (from the travel model) and estimated observed volume. During the adjustment process, an estimate of local (off-network) VMT is made using the ratio of local to non-local 2012 HPMS estimates applied to the adjusted model estimates. These ratios are also shown in Appendix F. These three steps, as shown below, reconcile the travel demand model with 2012 estimated observed volume.

- Applying the HPMS factors;
- Applying the seasonal factors; and
- Estimating local VMT.

The HPMS and seasonal factors are also applied to horizon year estimates of VMT; thereby reconciling horizon year estimates with the ratio of unexplained volume in the base year 2012. This reconciliation ultimately allows the travel model to provide an estimate for all regional VMT.

Travel demand model outputs simulate volume in four time periods, while the MOVES model utilizes hourly inputs. Therefore, vehicle type pattern files are used to convert simulated period volume into hourly volume. The vehicle type pattern files are broken into four vehicle classes (motorcycle, 2-axle 4-tire, bus, and 2-axle 6-tire/3+ axle). These files are developed using two types of counts: observed counts taken hourly for all vehicles; and hourly classified counts (FHWA F-13 scheme), summarized by facility and area type (urban/rural). The counts are used to develop estimates of the share of the volume per hour. These estimates are applied against the simulated link time period volume (a.m. and p.m. peak, mid-day and overnight) by facility and area type.

Each link's hourly vehicle type volume is compared against the modification to the Bureau of Public Roads curve used in the travel demand model. As with the travel demand model, Passenger Car Equivalence is used for the estimated truck volume. Each hourly volume is also subject to peak spreading where individual hourly volumes that exceeds 30% of the maximum volume is spread to other hours within the peak period. The final estimate is a new travel time and speed estimated on each HPMS adjusted link volume considering peak spreading.

Standard MOVES input files of VMT by facility, VMT by hour, and VMT by speed bin are developed using information from the travel model and air quality post-processor. An exact description of the data estimated can be found in the *MOVES 2014a User Guide* developed by EPA. The fraction of VMT for each vehicle type is calculated from the HPMS adjusted link volume.

Central then assembles the MOVES information such as source type population for the Baltimore region, environmental conditions (such as temperature), control programs, and transportation information described in the above steps. National defaults are used for the more complex and data intensive inputs into MOVES. MOVES scripts are built for each area type (urban or rural) and facility type within each jurisdiction (only for the assembly of the transportation information, since neither environmental conditions nor control programs vary across the non-attainment area).

The assembled MOVES scripts are submitted to the MOVES software, which generates the database output (ASCII database) and the report. The output gives the gram per mile emission factors for each pollutant, for each of the vehicle types. The gram per mile factor is a composite factor based on the age distribution, transportation characteristics, environmental conditions, and control program applicable for that vehicle type.

The MOVES model generates a VMT fraction share for all vehicle types based on supplied information (registration data, diesel sales fractions, and mileage accumulation rates). This fraction share can be used to generate a composite emission factor that can be applied to the estimated VMT or can be used to convert regional VMT into an estimate of VMT for each vehicle type and then factored by the gram per mile emission factor for that particular vehicle.

Both methods would produce the same estimate of VMT. The latter method is used in order to generate more specific reports about emissions and VMT for the region.

The final step is to accumulate the estimate of VMT and emissions for the various vehicle types and facility types.

Meteorological and Control Strategy Assumptions

In cooperation between BMC and MDE staff, assumptions used within the MOVES 2014a emissions model are reviewed and validated with the latest information on environmental conditions and MOVES 2014a commands representing control strategies and other policies.

The monthly analysis of mobile source emissions required the development of average hourly and monthly temperatures and humidity along with daily estimate of barometric pressure. The BWI weather reporting station observations were analyzed to develop the required input. Other monthly assumptions in fuel composition and volatility were estimated or used the MOVES default for that month.

The MOVES script for the Inspection and Maintenance program reflects the current test procedures in use at the various state inspection stations.

ANALYSIS RESULTS

The results of the emissions analysis of the 2019-2022 TIP and the Amended *Maximize2040*, as shown in Tables 5 and 6 below, demonstrate that emissions are below levels necessary to demonstrate conformity to both the 1997 8-hour ozone standard and the 2008 8-hour ozone standard.

Average summer weekday emissions of VOCs and NOx resulting from the region's transportation network in 2020, 2030, and 2040 are below the most recent approved/ adequate SIP budgets.

Table 5. VOC Emissions Test Results (average summer weekday, tons/day)

	2020	2030	2040
Total Emissions Modeled	22.2	12.8	10.0
Conformity Budget[1]	40.2	40.2	40.2
Conformity Result	**Pass**	**Pass**	**Pass**

[1] 2012, 8-hour ozone Reasonable Further Progress (RFP) SIP budget for the Baltimore region (motor vehicle emission budgets determined adequate by EPA on February 22, 2016)

Table 6. Weekday NOx Emissions Test Results (average summer weekday, tons/day)

	2020	2030	2040
Total Emissions Modeled	49.1	22.8	18.7
Conformity Budget[1]	93.5	93.5	93.5
Conformity Result	**Pass**	**Pass**	**Pass**

[1] 2012, 8-hour ozone Reasonable Further Progress (RFP) SIP budget for the Baltimore region (motor vehicle emission budgets determined adequate by EPA on February 22, 2016)